

Physical activity level, level of stress and cardiopulmonary functions in secondary school teachers in Lagos state

Aweto HA, Akinagbe OE

Department of Physiotherapy,
Faculty of Clinical Sciences,
College of Medicine,
University of Lagos, PMB
12003, Idi-Araba, Lagos,
Nigeria.

Address correspondence to

*Happiness Anulika Aweto,
E-mail:

awetohappiness@gmail.com
or haweto@unilag.edu.ng

Phone number:

+2348028964385 or

+2347032790407

ABSTRACT

Objective: The purpose of this study was to determine the physical activity level, stress level, cardiopulmonary function and relationship among these variables in secondary school teachers in Lagos State.

Methods: Four hundred and thirty-seven (n=437) secondary school teachers in Lagos state participated in this cross sectional analytical survey. They were selected across three out of the six education districts present in the state. A self-administered, short form of the International Physical Activity Questionnaire was used to assess physical activity level and the Teacher Stress Inventory was used to assess stress level. A digital sphygmomanometer was used to assess blood pressure and a spirometer was used for assessing pulmonary parameters. Statistical Package for Social Sciences version 22 was used for data analysis. Spearman's rank correlation was used to determine the association between variables at alpha value of $p < 0.05$.

Results: Overall, 59% of the respondents were physically active. 66.8% had moderate levels of stress, and 27.7% and 31.6% had elevated systolic and diastolic blood pressure respectively. Their mean forced expiratory volume in one second (FEV₁) and forced vital capacity (FVC) were 1.91 ± 0.55 L and 2.10 ± 0.58 L respectively. A significant relationship existed between physical activity level and FEV₁ as well as FVC ($p < 0.05$).

Conclusion: Above half of the secondary school teachers in Lagos are physically active, have moderate levels of stress and being physically active improves their lung functions. Consequently, strategies to promote physical activity, reduce stress, and create awareness on the health benefits of being physically active and reducing stress are needed among secondary school teachers in the state.

Keywords: Physical activity, stress, teachers, cardiopulmonary function.

Introduction

The rate at which the global work environment is changing these days is almost unbelievable. Over the millennia, there have been technological advancements with more effective and

less physically demanding techniques. However, these varying technological progress and industrialization of the workplace have led to a decrease in physical activity, an increase in sedentary

behaviour and other associated health risks.¹

Tremblay *et al*² defined the term physical inactivity as performing insufficient amounts of moderate to vigorous-intensity activity (i.e., not meeting specific physical activity guidelines). It has been proven that low levels of physical activity and excess body weight are closely linked.³ Woessner *et al*⁴ also stated that the increase in physical inactivity and sedentary behaviours is strongly related to obesity with great health consequences. The World Health Organization⁵ described physical inactivity as one of the leading risk factors of mortality relating to non-communicable diseases. Individuals that are not sufficiently active have a 20%-30% risk of mortality compared to sufficiently active people.⁵ On a global level, there was a 22.7% total death increase resulting from non-communicable diseases as discovered in a 10-year review (2007-2017) by Roth *et al*.⁶ Physical inactivity increases with age and this also increases the risk of developing ischaemic heart disease.⁷ Physical inactivity is a modifiable health risk factor. In a study of the Brazilian population by Silva *et al*⁸, the promotion of physical activity was projected to prevent early mortality.

A short-term reduction in physical activity in untrained individuals has a significant impact on skeletal muscle protein and carbohydrate metabolism, causing anabolic resistance and peripheral insulin resistance, respectively.⁹ A functional decline, a reduction in cardiorespiratory fitness, muscle mass and muscle strength are some of the effects of physical inactivity.⁹

Physical inactivity is therefore a key factor in the aetiology and progression of chronic diseases, including cardiovascular and metabolic diseases which are common, debilitating and costly.¹⁰ Medina *et al*¹¹ projected a decrease in the incidence and mortality from cardiovascular diseases and type 2 Diabetes Mellitus in Mexico if the prevalence of physical inactivity could be reduced.

Decreased physical activity and increased sedentariness have been linked with increased level of stress.¹² Physiological stress system dysfunction is related to obesity and poorer objective physical function.¹³ It is described as a sense of being overwhelmed, worried, exhausted, and overcome with lethargy. Therefore, stress can influence people of every age, sex, race, and situation and can result in both physical and psychological health problems.¹⁴ In medicine and biology, stress is called any physical, psychological, and/or emotional factor which results in physical, and/or psychological tension.¹⁵ Stress is the millennium's problem because today's life is mixed up with stress in all its aspects.^{16,17}

New technology has further resulted in a reduction in physical activity resulting in lower daily energy expenditure observed in modern living. With this, the consequences of physical inactivity seem likely to worsen.^{4,18} Rapid changes in knowledge and technology result in vast alterations in the structures and goals of organizations. These alterations in the nature of organizations have an influence on the increased number of stressful workplaces which is evidenced in

different ways. These include the uncontrollability of the workplace, fewer holidays, more working hours, insufficient rewards, fragile future of occupational promotions, increase in time pressure, lack of support, harassment, role conflict, and issues related to job-life balance.¹⁹ One of the occupations that have often been considered as being very stressful is teaching.^{20,21}

Teaching is the process of attending to people's needs, experiences and feelings, and intervening so that they learn particular things, and go beyond the given.²² Teaching as a profession is a demanding job that requires highly intellectual activities however, there are various intellectual symptoms of stress that can affect people in the profession, these include memory problems, confusion, poor judgment, and lack of concentration, while the emotional symptoms can be anger, irritation, moodiness, and depression, all of these can have negative adverse effects on the teachers' functionality.²³ Some of the causes of increased stress in teachers are; high psychological task demands, negative organizational alterations, lack of developmental opportunities, high job demands, lack of learning opportunities, lack of autonomy and influence, lack of social and organizational job support, perceived pupil misbehaviour and poor relationship with pupils.²⁴

Teachers are subjective insiders involved in classroom instructions as they go about their daily routines of instructing students, grading papers, taking attendance, evaluating their performance as well as looking at the curriculum.²⁵ Most activities carried out by teachers are

low in energy expenditure for instance long hours spent in setting and grading papers and preparing a work plan.

The study conducted by Ololube²⁶ assessed the relationship between the level of teachers' job satisfaction, motivation and their teaching performance in Rivers State, Nigeria. The results of the survey revealed that teachers' dissatisfaction was associated with educational policies, administration, pay and fringe benefits, material rewards and advancement. In more than 70% of school teachers, occupational distress leads to physical problems, anxiety problems, insomnia, incompetence in social roles, and depression.²⁷ This study was designed to evaluate the physical activity level, level of stress, cardiopulmonary functions and relationship among these variables in secondary school teachers in Lagos state.

Materials and Methods

Selection of participant in this study involved a multi stage sampling technique. Three education districts (Districts I, II and VI) out of the six present in Lagos state were selected using fish bowl technique where each of the district numbers was written on a paper, squeezed and dropped in a bowl. They were juggled together before the picking was done. Two local government areas (LGAs) were selected for each education district using the fish bowl technique as well. The selected LGAs were: Agege and Alimosho LGAs for District I, Somolu and Kosofe LGAs for District II and Ikeja and Mushin LGAs for District VI. Secondary schools were randomly selected per LGA. In all, eleven secondary schools were

selected from district I, twelve for district II and eleven for district IV. Four hundred and thirty-seven (437) teachers were randomly selected from the selected secondary schools across the selected LGAs. They were selected based on the inclusion and exclusion criteria of this study. Teachers with history of cardiac surgery and cardiac pacemaker were excluded as well as teachers with chronic respiratory disorders. The sample size for this study was calculated using the formula developed by Cochran²⁸ which is:

$$n = \frac{Z^2 (pq)}{e^2}$$

where,

n= desired sample size

Z²= is the abscissa variate usually set at 1.96, confidence level is 95%.

p= estimated population of an attribute that is present in the population in this case 0.46

q= 1-p = 1-0.5= 0.5

e= desired level of precision set at 0.05

$$n = \frac{1.96^2 (0.5 \times 0.5)}{0.05^2}$$

n=384.

Ethical approval was sought and obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital, Idi-Araba, Lagos (ADM/DCST/HREC/APP/3391). Prior to participation, written informed consent was obtained from all participants. Approval was also sought and obtained from Lagos state government (Registration No: EDI/154/VOL.V/361) for education district I and from the school principals in the other districts (II&VI).

Research Procedure

The purpose of this study was explained to the participants; written informed consent was sought and obtained from them before participation. In the course of this study, two questionnaires were used. The short form of International Physical Activity Questionnaire (IPAQ) was used to assess the physical activity level and Teacher Stress Inventory (TSI) was used to assess the level of stress in each individual. The participants were given copies of the questionnaires which were completed individually. The baseline characteristics of all participants were recorded at the beginning of the study, which included; age, height, weight, blood pressure, pulmonary function parameters. Height and weight were measured using standiometer and weighing scale respectively. Pulmonary Function parameters (forced vital capacity (FVC), forced expiratory rate volume in 1 second (FEV₁), and Peak expiratory flow rate (PEFR)) were assessed using a spirometer. The participants were instructed to avoid wearing tight clothing and refrain from eating and drinking for at least 1 hour before the measurements.²⁹ This was to prevent factors like bloating from affecting the results. The age, sex, height (m), weight (kg) and smoking status were inputted into the spirometer before the readings were taken. In a seated position, each participant was asked to take a deep breathe in. With clipped nose and lips sealed around the mouthpiece of the spirometer they were asked to breathe out forcefully and as long as they could into the spirometer till the lungs felt completely empty. After each use by a participant, the spirometer was cleaned with alcohol wipes and a

different mouthpiece inserted for the next participant's use. The reading was taken three times and the highest value was recorded. The participants' blood pressure [Systolic blood pressure (SBP) and Diastolic blood pressure (DBP)] was measured using a digital sphygmomanometer and this was done after at least 15 minutes of rest. The measurements were taken twice on the same arm and the average values of the two measurements were obtained by adding the systolic values then dividing by two. The same was done for the diastolic blood pressure.

Data Analysis

Data was analysed using Statistical Package for Social Sciences (SPSS) Windows Version 22. Data was summarized using descriptive statistics of frequency, mean and standard deviation. Result was presented on tables. Inferential statistics of Spearman rank correlation was used to assess the relationship among levels of physical activity, stress and cardiopulmonary function parameters (SBP, DBP, FEV₁, FVC and PEF_R). Level of significance was set at $p < 0.05$.

Results

The mean age and body mass index (BMI) of the participants were 47.19 ± 8.58 years and 26.79 ± 5.42 kg/m² respectively. The other sociodemographic variables are also shown on Table 1.

Table 2 shows the educational and job profile of participants. Two hundred and eighty two (64.5%) of the participants had bachelor degree while only two (0.5%) had doctorate degree as their highest educational qualification. Two hundred and forty six (56.3%) of them taught

senior students. One hundred and thirty three (35.95%) taught 101 to 200 students daily and 388 (88.79%) taught non-physically challenged students. One hundred and ninety three (46.73%) of them had over 20 years teaching experience and 187 (49.73%) were on grade level 14 to 16. Four hundred and thirty two (99%) and four hundred and twenty six (97%) reported that they got support from their peers and supervisors respectively (Table 2).

Table 3 shows the physical activity level and the sitting time of the participants. One hundred and seventy-nine (41%) of the participants were inactive. Two hundred and ninety three (67.0%) of the participants reported that their sitting period in a week ranged from one to eight hours.

Table 4 shows the summary of the domains in the Teachers' Stress Inventory. Majority of the teachers had moderate levels of stress in all of the domains. Two hundred and ninety-two (66.8%) of them had moderate levels in the total stress score while 71 (16.2%) had high levels of stress.

The cardiopulmonary parameters of participants as well as the differences between males and females are represented in Table 5. The mean systolic blood pressure (SBP) was 128.28 ± 16.96 mmHg. The mean forced expiratory volume in the first second (FEV₁) was 1.91 ± 0.55 L. There were significant differences between male and female participants' mean values of pulmonary parameters and DBP ($p < 0.05$).

Concerning the classification of the blood pressure of the participants, 139 (31.8%) of the participants had normal SBP ($<$

120mmHg), 121 (27.7%) had elevated SBP (120-129 mmHg), 86 (19.7%) had High Blood Pressure 1 (SBP= 130-139 mmHg) and 91 (20.8%) had High Blood Pressure 2 (SBP= $\geq$ 140 mmHg). Two hundred and thirty seven (54.2%) had normal DBP, 138 (31.6%) had High Blood Pressure 1 (DBP= 80-89 mmHg) and 62 (14.2%) had High Blood Pressure 2 (DBP= $\geq$ 90mmHg).

Spearman's correlation coefficient analysis showed that there was significant relationship between Physical activity level (PAL) and FEV₁ ($P < 0.05$) as well as FVC ($P < 0.05$) of the participants. There was no significant relationship between PAL and other cardiopulmonary function parameters (SBP, DBP, PEFr) ($P > 0.05$) (Table 6)

There was no significant relationship between level of stress and cardiopulmonary function parameters ($P > 0.05$) as well as PAL ($P > 0.05$) of the participants (Table 7).

Discussion

The observation that 59% of the secondary school teachers in Lagos state were physically active implies that about six out of ten secondary school teachers in Lagos state met the IPAQ recommendations for minimally active (≥ 600 MET) and highly active. This may be due to low socioeconomic status of the teachers. This observation is similar to that reported among adults (59.2%) in south-western Nigeria.³⁰ It is slightly higher than the prevalence of 53.7% of teachers in South-eastern Brazil reported by Brito *et al*³¹ and also 56.7% senior civil servants who were reported to be physically active in Lagos State.³² This prevalence is less than the physical active level reported for secondary school

teachers in Ibadan, Nigeria (95.7%), Nigerian adults (78%) and high school teachers in Osijek-Baranja County, Republic of Croatia.³³⁻³⁵

The secondary school teachers who were under moderate level of stress in this study were 66.8% and those that had high level of stress were 16.2%. This implies that 83% of these teachers were under moderate to high level of stress which is very high. The COVID-19 pandemic and the resultant changes in work schedule during the period of this study may have contributed to this high level of stress among these secondary school teachers. The prevalence of secondary school teachers in this study who were under moderate to high level of stress was much higher than the 32.3% of secondary school teachers in Klang, Malaysia who reported to have high level of stress.³⁶ It was also higher than a prevalence of 58.2% of public secondary school teachers under stress in Gondar, Ethiopia and 72.2% of secondary school teachers in Ibadan, Nigeria.^{37,38} However, the level of stress in this study was less than the prevalence of 100% among Egyptian teachers as reported by Desouky and Allam.³⁹

A significant positive relationship existed between PAL and FEV₁ and FVC in this study. This implies that when there is an increase in PAL, there will be increase in FEV₁ and FVC. This may be as a result of the increase in demand for more oxygen when there is an increase in PAL so the lungs increase their capacity to meet this demand. A study among healthy adults in Canada by Dogra *et al*⁴⁰ showed PAL was positively associated with FEV₁ and FVC. Another study in the region of Augsburg,

Germany carried out by Luzak *et al*⁴¹ also observed a positive association.

In this study, there was no significant relationship between PAL and blood pressure (SBP and DBP) of the teachers. This is consistent with the report by Zulkepli *et al*⁴² who observed that there was no significant relationship between PAL and blood pressure in school teachers in Kuala Lumpur. This was not the case in the study carried out by Kubesch *et al*⁴³ where PAL and blood pressure was significantly associated; with an increase in PA leading to a decrease in blood pressure. The explanation provided for this was that participation in aerobic exercises reduces blood pressure at the long run. Damtie *et al*⁴⁴ who carried out a study among secondary school teachers in Bahir Dar City Administration, Northwest Ethiopia observed significant relationship between physical inactivity and increased blood pressure.

There was no significant relationship between stress and cardiopulmonary function parameters. This implies that the stress level of the teachers has no effects

on the cardiopulmonary function parameters of the teachers. Lecca *et al*⁴⁵ also observed a similar result where there was no significant relationship between job stress and cardiovascular disease risk.

There was no significant relationship between PAL and level of stress among the teachers. This implies that the PAL of teachers did not affect their stress level. Fitzgerald⁴⁶ reported a significant relationship between PAL and job burnout in primary school teachers in Ireland; higher levels of physical activity predicted lower levels of stress. A study by Sane *et al*⁴⁷ among academic members of Daregaz Universities observed a higher level of job stress in members with low PAL.

Conclusion

More than half of the teachers were active. Moderate level of stress was present in 66.8% of the teachers. Physical activity level was not related to systolic blood pressure, diastolic blood pressure, and stress. However, as PAL increased, lung volumes (FEV₁, FVC) increased in the teachers.

Table 1: Socio-demographic variables of the participants

Variables	Frequency (n=437)	Percentage (%)
Age group (Years)		
21-30	19	4.3
31-40	94	21.5
41-50	118	27.0
51 and above	206	47.1
Mean age (years) =		

47.19 ± 8.58

Height group (m)

1.50-1.59	38	8.7
1.60-1.69	226	51.7
1.70-1.79	151	34.6
1.80 and above	22	5.0

Mean height (m) =
1.68 ± 0.06

Weight group (kg)

40-60	60	13.7	301-400	36	9.73
60-80	237	54.2	401-500	18	4.86
80-100	115	26.3	>500	14	3.78
100-120	20	4.6	Condition of students taught		
120-140	3	0.7	Physically challenged	4	0.91
140-160	2	0.5	Non-physically challenged	388	88.79
Mean weight (kg) = 75.82 ± 15.27			Both	45	10.29
BMI (Kg/m²)			Years of experience		
<18.5	13	3.0	0-5	29	7.02
18.5-24.9	158	36.2	6-10	56	13.56
25-29.9	168	38.4	11-15	94	22.76
≥30	98	22.4	16-20	41	9.93
Mean BMI (kg/m²) = 26.79 ± 5.42			>20	193	46.73
Females	306	70.0	Professional rank		
Males	131	30.0	Grade level 8-10	87	23.14
			11-13	97	25.80
			14-16	187	49.73
			>16	5	1.33
			Support from peers		
			Yes	432	99
			No	5	1
			Support from supervisors		
			Yes	426	97
			No	11	3

Table 2: Educational and Job profile of the participants

Variables	Frequency (n)	Percentage (%)
Qualification		
Bachelor's degree	282	64.5
Higher National Diploma (HND)	4	0.9
Master's degree	87	19.9
National Certificate of Education (NCE)	6	1.4
Doctorate degree	2	0.5
Post Graduate Diploma in Education (PGDE)	35	8
Section of school taught		
Junior	191	43.7
Senior	246	56.3
Number of students taught daily		
0-100	102	27.57
101-200	133	35.95
201-300	67	18.11

Table 3: Classification of Participants Physical Activity Level

Characteristics	Frequency	Percentage (%)
Physical activity:		
Inactive	179	41.0
Minimally active	118	27.0
Highly active	140	32.0
Total	437	100
Sitting period in a week		
1-8 hours	293	67.0
9-16 hours	25	5.7
Don't know/ not sure	119	27.3
Total	437	100.0

Table 4: The summary of the domains in the Teacher Stress Inventory

TSI total strength	Cut-off*	Frequency (n=437)	Percentage (%)
TM			
High	3.51 and above	60	13.7
Moderate	2.13-3.51	288	65.9
Low	2.13 and below	89	20.4
WRS			
High	3.76 and above	71	16.2
Moderate	2.07-3.76	297	68.0
Low	2.07 and below	69	15.8
PD			
High	3.06 and above	79	18.1
Moderate	1.26-3.06	267	61.1
Low	1.26 and below	91	20.8
DAM			
High	3.52 and above	73	16.7
Moderate	1.42-3.52	265	60.6
Low	1.42 and below	99	22.7
PI			
High	3.22 and above	86	19.7
Moderate	1.19-3.22	246	56.3
Low	1.19 and below	105	24.0
EM			
High	3.25 and above	85	19.5
Moderate	1.09-3.25	245	56.1
Low	1.09 and below	107	24.5
FM			
High	3.53 and above	81	18.5
Moderate	1.62-3.53	271	62.0
Low	1.62 and below	85	19.5
CVM			
High	3.62 and above	92	21.1
Moderate	1.25-3.62	244	55.8
Low	1.25 and below	101	23.1
GM			
High	2.79 and above	75	17.2
Moderate	0.71-2.79	362	82.8
Low	0.71 and below	0	0
BM			
High	2.61 and above	59	13.5
Moderate	0.78-2.61	378	86.5
Low	0.78 and below	0	0
Total Stress			
High	2.97 and above	71	16.2
Moderate	1.67-2.97	292	66.8
Low	1.67 and below	74	16.9

*-Cut-off points for significance levels were set at ± 1 standard deviation around the mean of each subsample (Fimian, 1988)

KEY:

TM- Time Management

WRS-Work-related Stressors

PD- Professional distress

DAM- Discipline and motivation

EM- Emotional Manifestation

FM- Fatigue Manifestation

CVM- Cardiovascular Manifestation

GM- Gastronomical Manifestation

BM- Behavioural Manifestation

PI- Professional investment

Table 5: Cardiopulmonary function parameters of the participants

Variables	Combined Mean $\pm$ SD	Male Mean $\pm$ SD N=131	Female Mean $\pm$ SD N=306	t- value	p-value
SBP (mmHg)	128.28 $\pm$ 16.96	130.63 $\pm$ 16.41	127.3 $\pm$ 17.1	-1.929	<0.055
DBP (mmHg)	79.22 $\pm$ 11.23	81.86 $\pm$ 12.33	78.1 $\pm$ 10.6	-3.045	<0.003*
FEV ₁ (L)	1.91 $\pm$ 0.55	2.21 $\pm$ 0.56	1.78 $\pm$ 0.48	-7.838	<0.001*
FVC (L)	2.10 $\pm$ 0.58	2.44 $\pm$ 0.61	1.96 $\pm$ 0.51	-7.899	<0.001*
PEFR (L/ min)	4.13 $\pm$ 1.67	4.75 $\pm$ 1.57	3.87 $\pm$ 1.65	-5.300	<0.001*

*- Significant level $p < 0.05$

SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure; FEV₁- Forced Expiratory Volume in the first second; FVC- Forced Vital Capacity; PEFR- Peak Expiratory Flow Rate.

Table 6: Relationship between Physical Activity Level and Cardiopulmonary function Parameters of the participants

Variables	Physical Activity Level	
CPP	r_s -value	p-value
SBP (mmHg)	0.002	0.964
DBP (mmHg)	0.041	0.394
FEV ₁	0.122	0.011*
FVC	0.145	0.002*
PEFR	0.057	0.234

*- Significant level $p < 0.05$ r_s - Spearman correlation coefficient

SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure; FEV₁- Forced Expiratory Volume in the first second; FVC- Forced Vital Capacity; PEFR- Peak Expiratory Flow Rate; CPP- Cardiopulmonary function parameters.

Table 7: Relationship between cardiopulmonary function parameters and physical activity level and level of stress

Variable	Level of Stress	
	r_s -value	p-value
SBP	-0.058	0.225
DBP	-0.046	0.335
FEV ₁	-0.019	0.690
FVC	-0.016	0.735
PEFR	-0.018	0.711
PAL	0.036	0.458

r_s - Spearman correlation coefficient

KEY

PAL- Physical Activity Level

SBP-Systolic blood pressure

DBP- Diastolic blood pressure

FEV₁- Forced expiratory volume in the first second

FVC- Forced vital capacity

PEFR- Peak expiratory flow rate

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